

US010305229B2

(12) **United States Patent**  
**Zhao**

(10) **Patent No.:** **US 10,305,229 B2**  
(45) **Date of Patent:** **May 28, 2019**

(54) **ELECTRICAL CONNECTOR HAVING GROUND AND POWER CONTACTS EACH WITH PLURAL TAIL PORTIONS**

(71) Applicant: **FOXCONN INTERCONNECT TECHNOLOGY LIMITED**, Grand Cayman (KY)

(72) Inventor: **Jun Zhao**, Huaian (CN)

(73) Assignee: **FOXCONN INTERCONNECT TECHNOLOGY LIMITED**, Grand Cayman (KY)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/032,010**

(22) Filed: **Jul. 10, 2018**

(65) **Prior Publication Data**  
US 2019/0013627 A1 Jan. 10, 2019

(30) **Foreign Application Priority Data**  
Jul. 10, 2017 (CN) ..... 2017 2 0830803 U

(51) **Int. Cl.**  
**H01R 13/648** (2006.01)  
**H01R 13/6597** (2011.01)  
**H01R 13/6471** (2011.01)  
**H01R 43/24** (2006.01)  
**H01R 13/504** (2006.01)  
**H01R 13/6594** (2011.01)  
**H01R 24/60** (2011.01)

(52) **U.S. Cl.**  
CPC ..... **H01R 13/6597** (2013.01); **H01R 13/504** (2013.01); **H01R 13/6471** (2013.01); **H01R 13/6594** (2013.01); **H01R 43/24** (2013.01); **H01R 24/60** (2013.01)

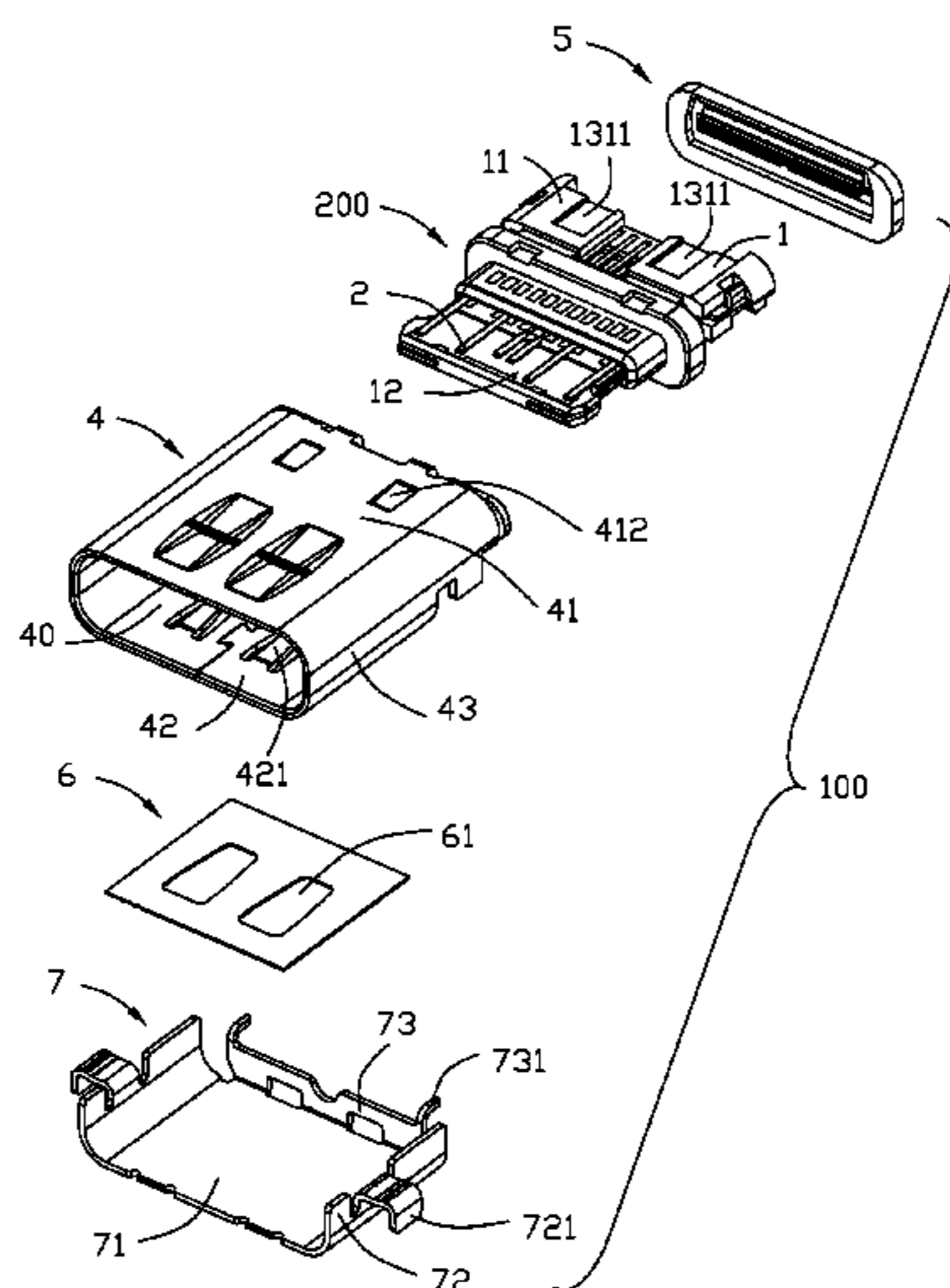
(58) **Field of Classification Search**  
CPC ..... H01R 13/6597; H01R 13/6594; H01R 43/24; H01R 13/6471; H01R 13/504; H01R 13/6477; H01R 13/658; H01R 13/6581; H01R 12/721  
USPC ..... 439/607.01  
See application file for complete search history.

(56) **References Cited**  
**U.S. PATENT DOCUMENTS**  
7,699,663 B1 \* 4/2010 Little ..... H01R 13/6471 439/660  
7,841,905 B2 \* 11/2010 Zheng ..... H01R 13/658 439/660  
8,052,431 B1 \* 11/2011 He ..... H01R 12/721 439/78  
8,376,785 B2 2/2013 Lapidot et al.  
(Continued)

**FOREIGN PATENT DOCUMENTS**  
CN 203813082 U 9/2014  
*Primary Examiner* — Jean D Duverne  
(74) *Attorney, Agent, or Firm* — Wei Te Chung; Ming Chieh Chang

(57) **ABSTRACT**  
An electrical connector includes: an insulative housing having a base and a tongue; two rows of contacts arranged in the insulative housing and exposed respectively to two opposite surfaces of the tongue, each row of contacts including an outermost ground contact and an adjacent power contact next to the ground contact; and a shielding shell enclosing the insulative housing, wherein each of the ground contact and the power contact in at least one of the two rows has a contacting portion, plural tail portions, and an intermediate portion between the contacting portion and the plural tail portions.

**5 Claims, 9 Drawing Sheets**



(56)

**References Cited**

U.S. PATENT DOCUMENTS

2005/0059296 A1\* 3/2005 Wang ..... H01R 13/6477  
439/541.5  
2009/0042450 A1\* 2/2009 Zheng ..... H01R 13/658  
439/660  
2011/0021088 A1\* 1/2011 Chen ..... H01R 13/6581  
439/732  
2016/0099526 A1 4/2016 Chen  
2016/0211593 A1\* 7/2016 Tsai ..... H01R 25/006  
2017/0018883 A1 1/2017 Chen et al.  
2017/0373442 A1\* 12/2017 Qiu ..... H01R 13/6581

\* cited by examiner

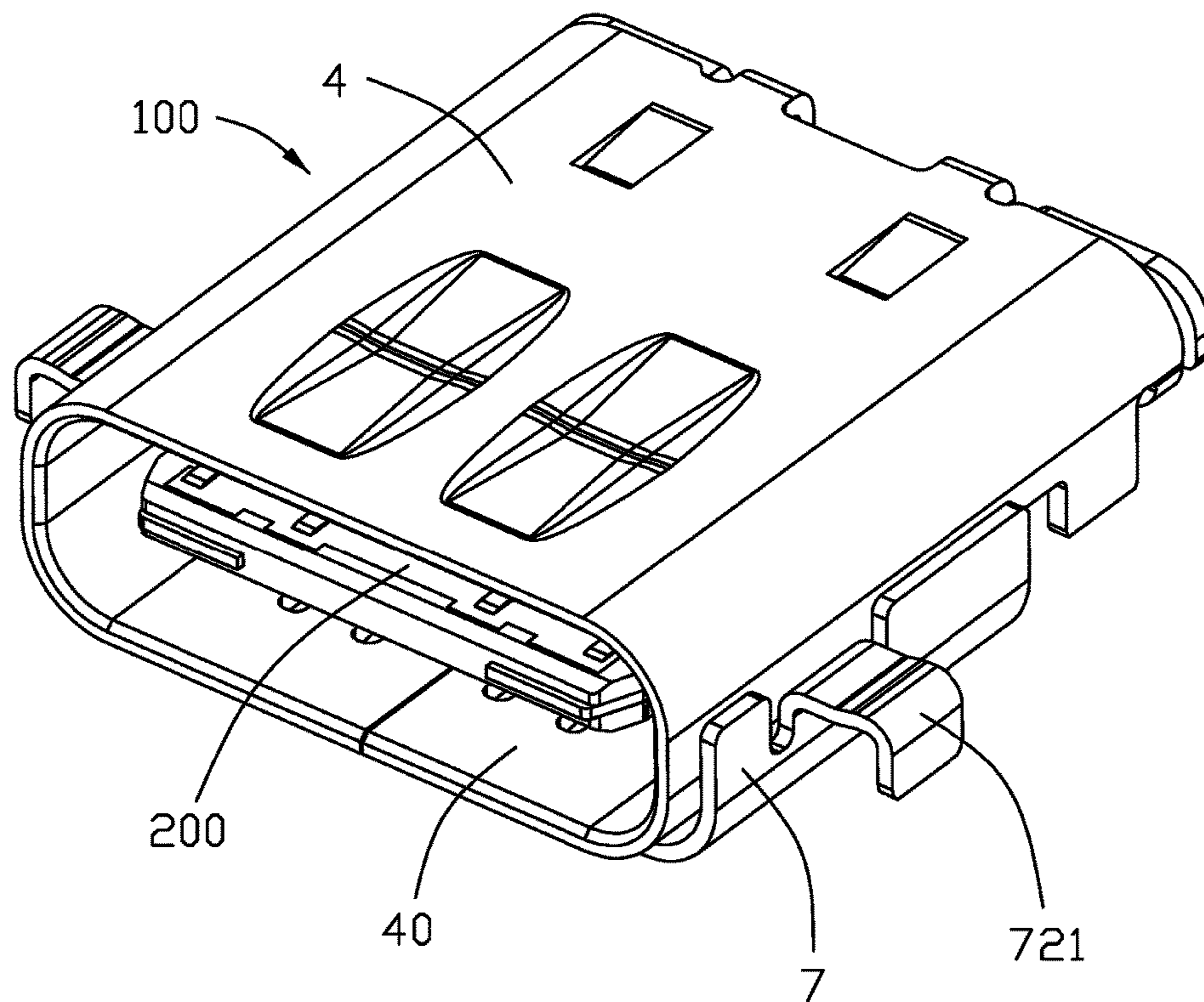


FIG. 1

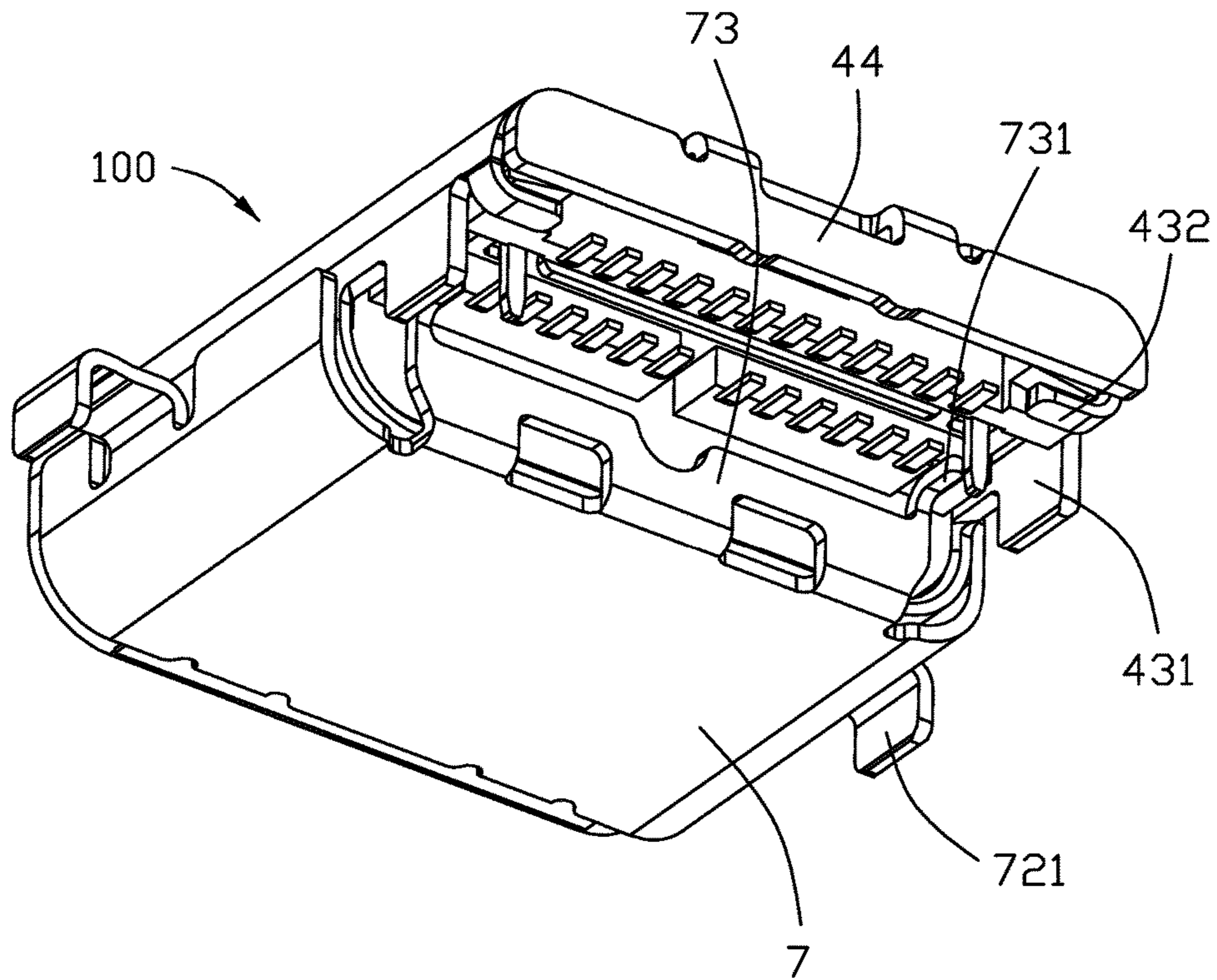


FIG. 2



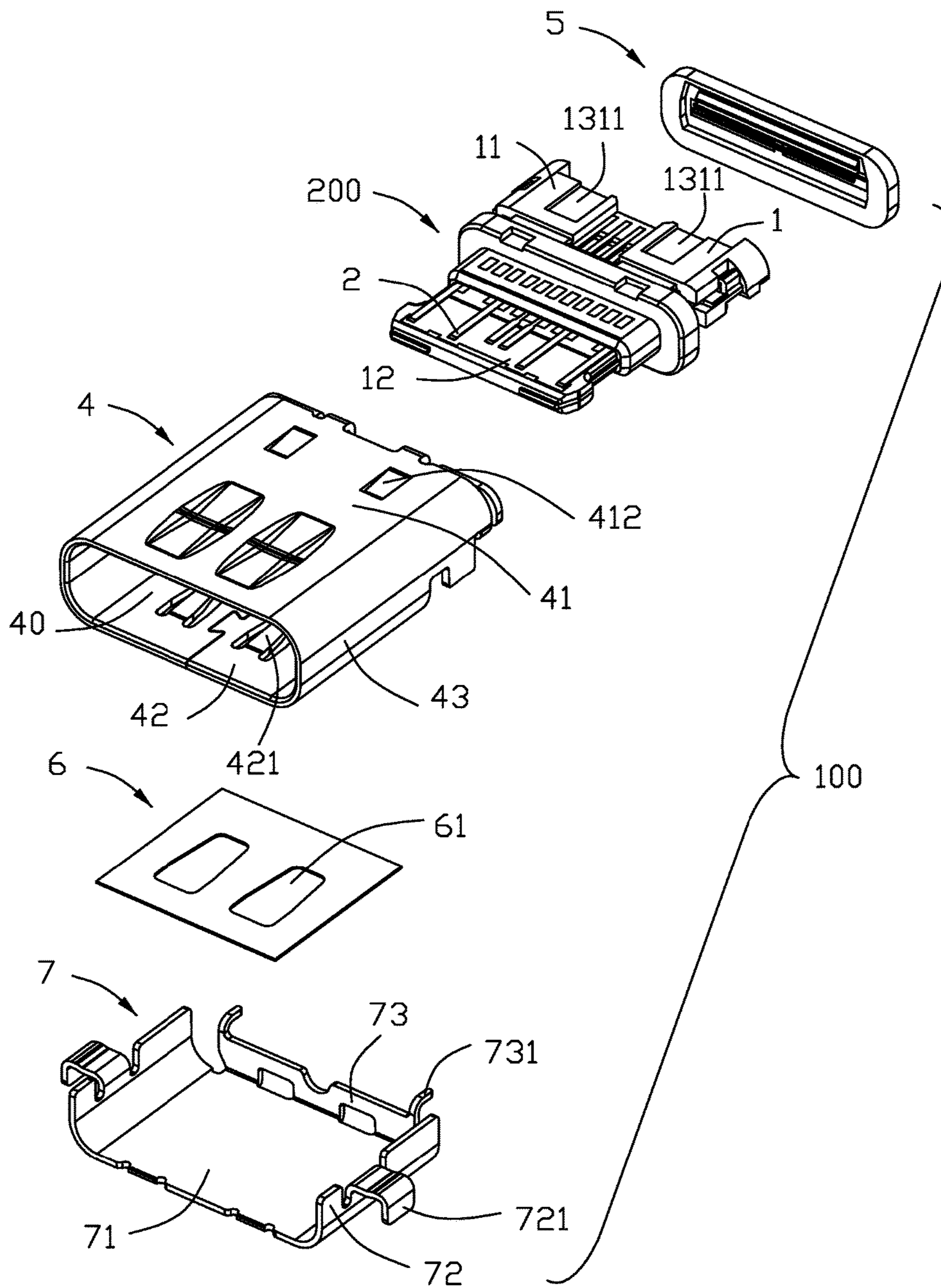


FIG. 3

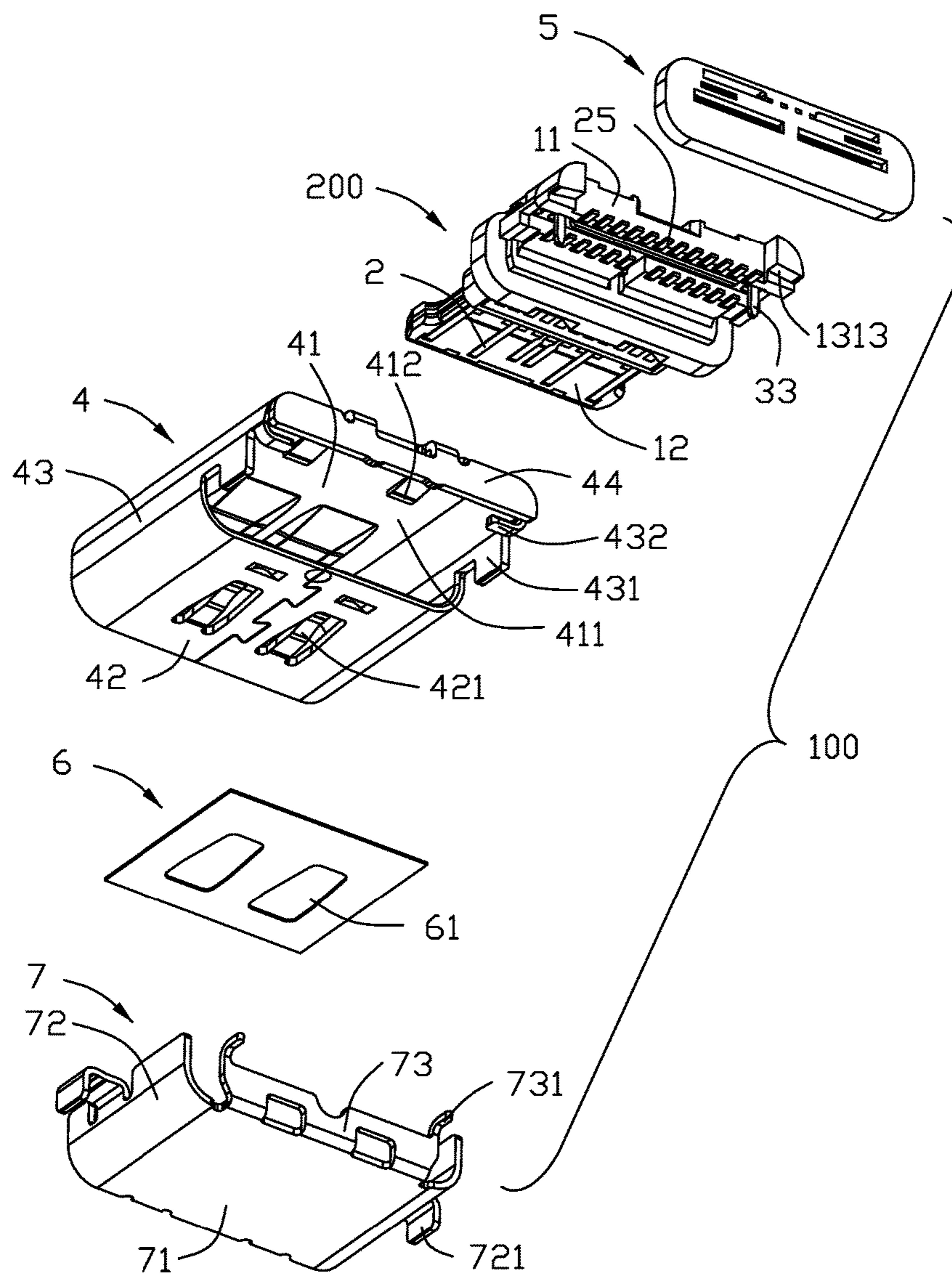


FIG. 4

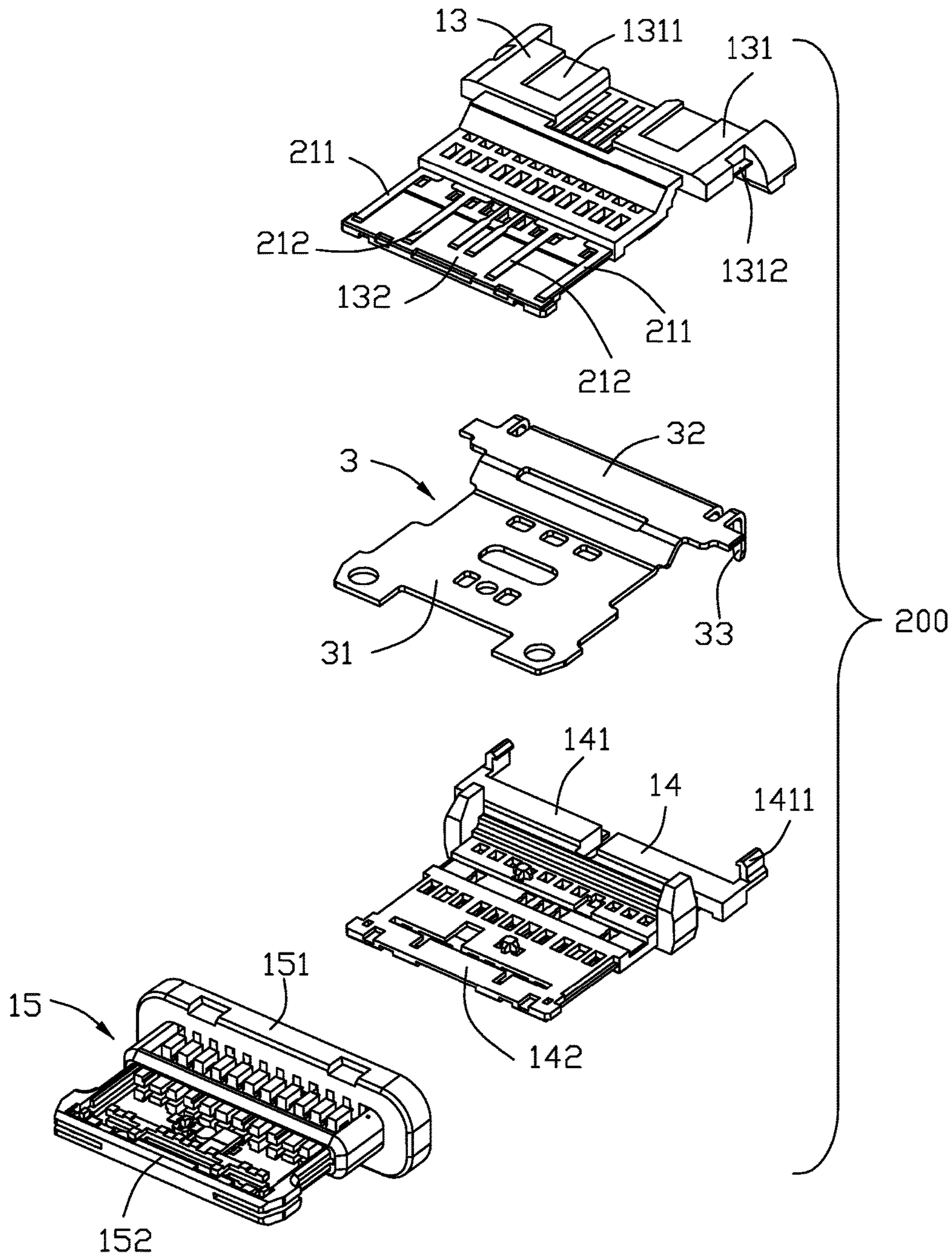


FIG. 5



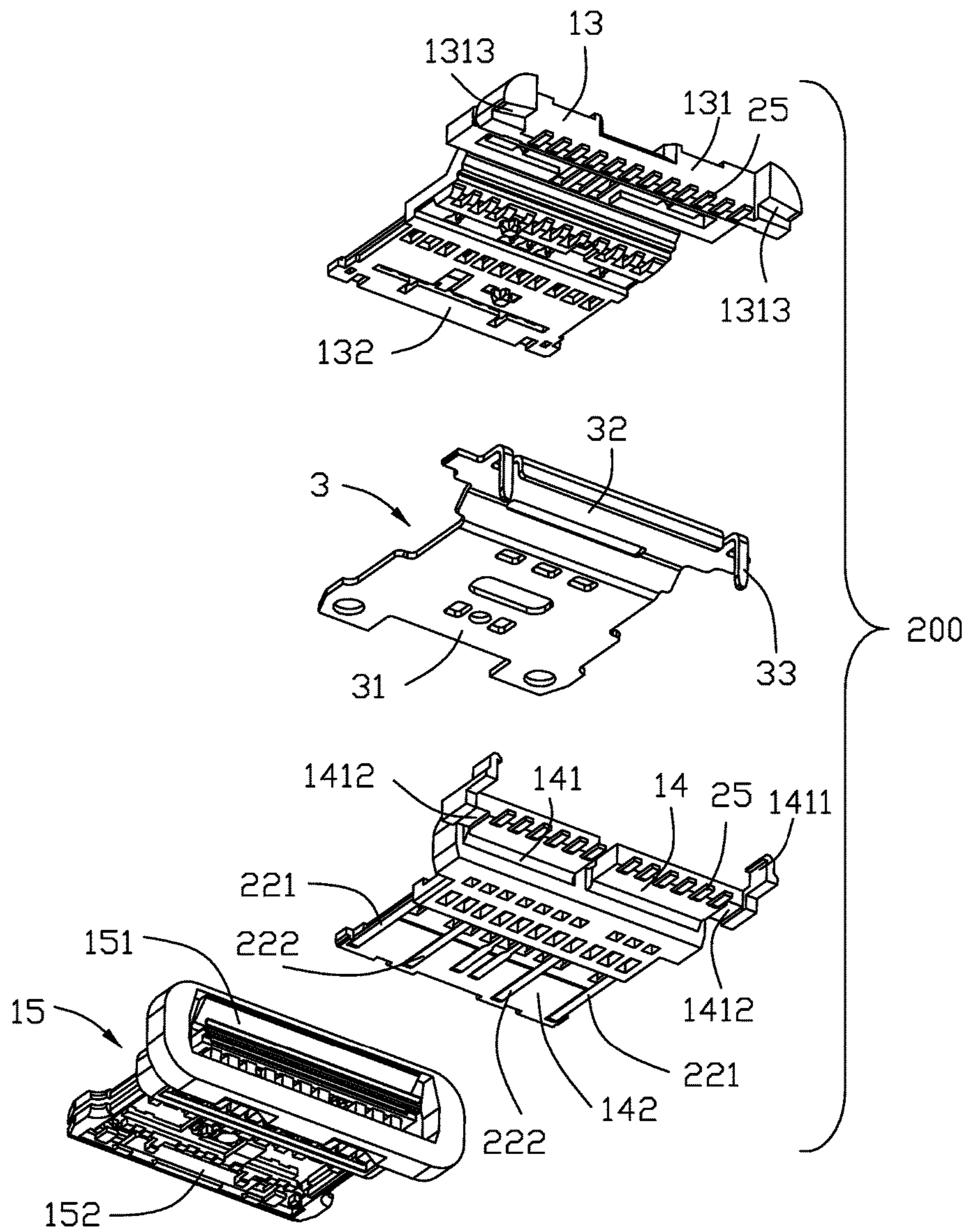


FIG. 6



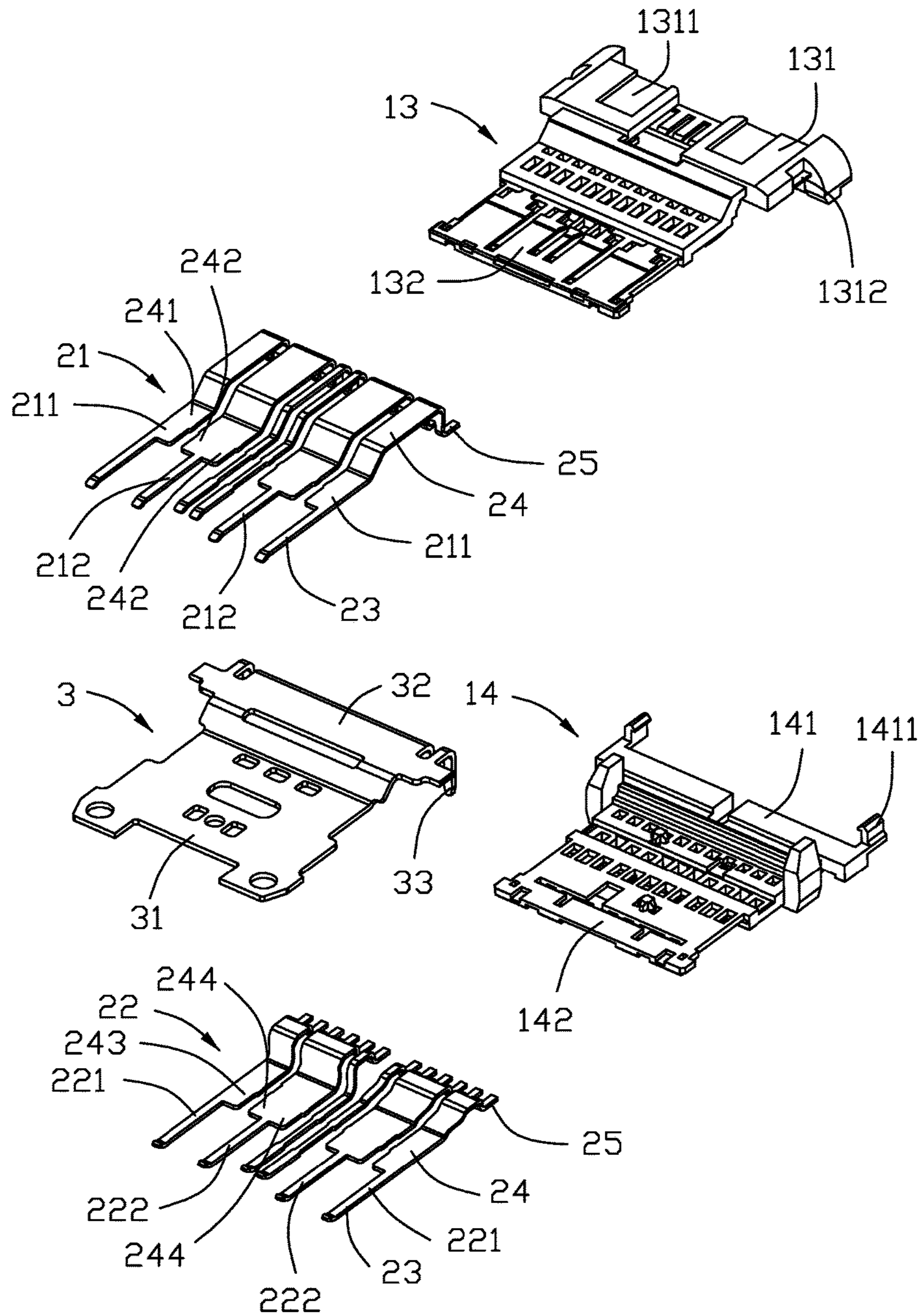


FIG. 7

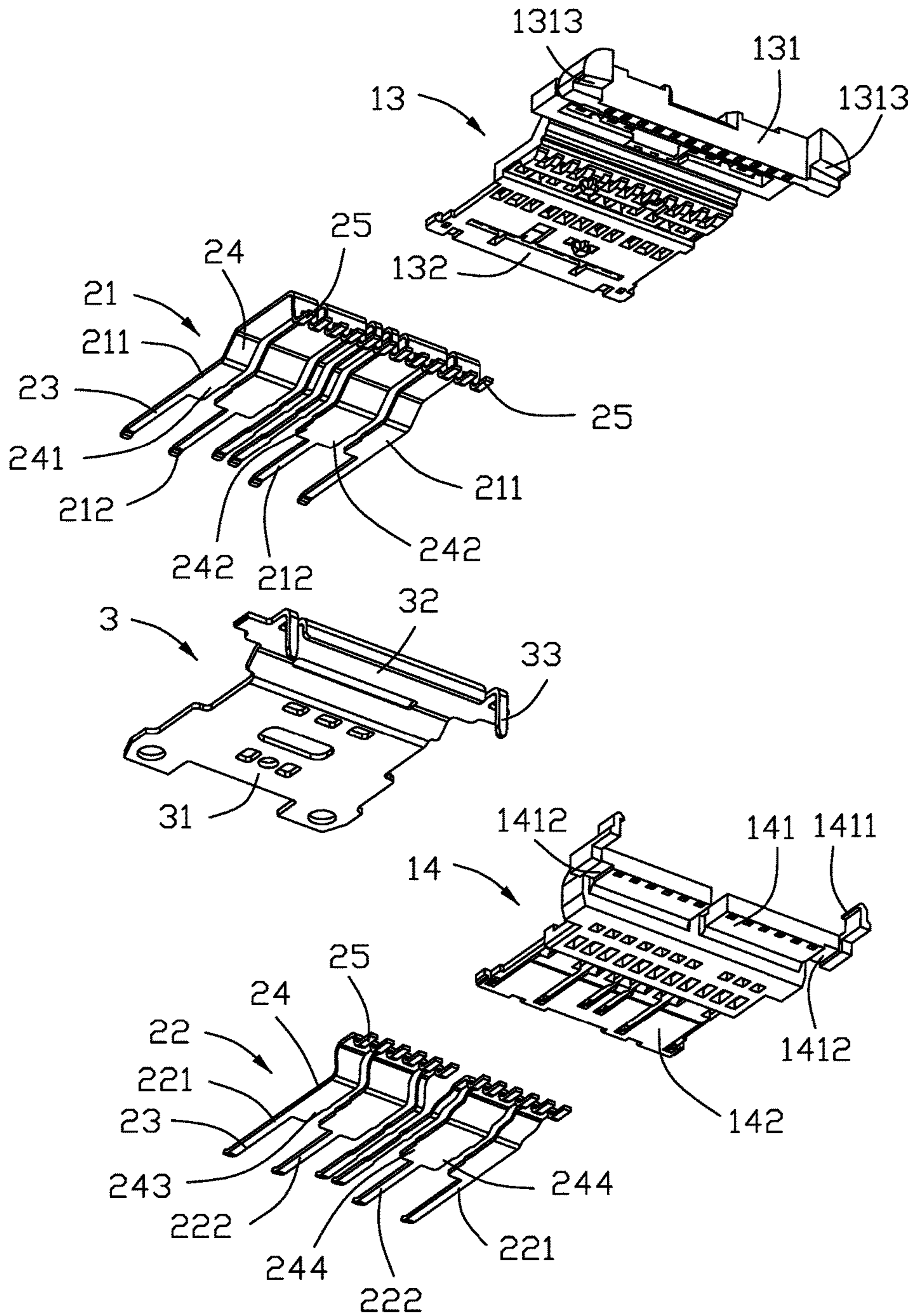


FIG. 8

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND			Vbus		D+	D-		Vbus			GND
GND			Vbus		D-	D+		Vbus			GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

FIG. 9



1

# ELECTRICAL CONNECTOR HAVING GROUND AND POWER CONTACTS EACH WITH PLURAL TAIL PORTIONS

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to an electrical connector having two rows of contacts including wide ground and power contacts to conduct large current, wherein each of the ground contact and the power contact has plural tail portions for current flow and heat dissipation consideration.

### 2. Description of Related Arts

U.S. Patent Application Publication No. 2017/0018883 discloses a dual orientation connector, e.g., a Universal Serial Bus (USB) Type-C connector, where a rightmost or leftmost ground terminal (Gnd) or a first supplemental terminal (SUB1) can be omitted. Furthermore, the ground terminal (Gnd) may be replaced by a power terminal (Power/VBUS) where a width of the power terminal (Power/VBUS) may be equal to a width of a first signal contact, or greater than the width of the first signal contact for large current transmission.

U.S. Pat. No. 8,376,785 describes a conventional USB3.0 connector having a first group of terminals and a second group of terminals where a ground terminal in the first group is depicted to have two tail portions.

## SUMMARY OF THE INVENTION

An electrical connector comprises: an insulative housing having a base and a tongue; two rows of contacts arranged in the insulative housing and exposed respectively to two opposite surfaces of the tongue, each row of contacts including an outermost ground contact and an adjacent power contact next to the ground contact; and a shielding shell enclosing the insulative housing, wherein each of the ground contact and the power contact in at least one of the two rows has a contacting portion, plural tail portions, and an intermediate portion between the contacting portion and the plural tail portions.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front perspective view of an electrical connector in accordance with the present invention;

FIG. 2 is a rear perspective view of the electrical connector;

FIG. 3 is an exploded view of the electrical connector;

FIG. 4 is another exploded view of the electrical connector;

FIG. 5 is a front exploded view of a contact module of the electrical connector;

FIG. 6 is a rear exploded view of the contact module;

FIG. 7 is a further exploded view of the contact module in FIG. 5 omitting an over-mold thereof;

FIG. 8 is a rear view of the contact module in FIG. 7; and

FIG. 9 is a schematic table showing contact arrangement of the electrical connector.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1-9, an electrical connector 100 comprises a contact module 200 and a shielding shell 4 enclosing

2

the contact module 200. The electrical connector 100 may further comprise a rear sealing element 5, a water-proof film 6, and an auxiliary shell 7.

Referring specifically to FIGS. 3-9, the contact module 200 includes an insulative housing 1, two rows of contacts 2 arranged in the insulative housing 1, and a shielding plate 3 arranged in the insulative housing 1 between the two rows of contacts 2.

The insulative housing 1 includes a base 11 and a tongue 12. The insulative housing 1 is constructed of an upper insulator 13 that is insert molded with an upper row of contacts 21, a lower insulator 14 that is insert molded with a lower row of contacts 22, and an over-mold 15. The upper insulator 13 has a base part 131 and a tongue part 132. The base part 131 has a pair of recesses 1311, a pair of latches 1312, and a pair of engaging faces 1313. The lower insulator 14 has a base part 141 and a tongue part 142. The base part 141 has a pair of hooks 1411 and a pair of grooves 1412. The over-mold 15 a base part 151 and a tongue part 152. The base parts 131, 141, 151 constitutes the base 11 of the insulative housing 1. The tongue parts 132, 142, 152 constitute the tongue 12 of the insulative housing 1.

Referring specifically to FIGS. 7-9, as is well known in this art, the upper row of contacts 21 and the lower row of contacts 22 are reversely-symmetrically arranged and each contact 2 has a contacting portion 23, a tail portion 25, and an intermediate portion 24 between the contacting portion and the tail portion.

As shown in FIG. 9, the upper row of contacts 21 include a pair of ground contacts 211 at positions A1 and A12, a pair of power contacts 212 at positions A4 and A9, and a pair of signal contacts at positions A6 and A7. Positions A2-A3, A5, A8, and A10-A11 are vacant. Similarly, the lower row of contacts 22 include a pair of ground contacts 221 at positions B1 and B12, a pair of power contacts 222 at positions B4 and B9, and a pair of signal contacts at positions B6 and B7. Positions B2-B3, B5, B8, and B10-B11 are vacant.

In the upper row of contacts 21, for the pair of ground contacts 211 at positions A1 and A12, corresponding intermediate portion 24 has a respective widened section 241 to also occupy neighboring position A2 or A11. Moreover, each ground contact 211 has two tail portions 25. For the pair of power contacts 212 at positions A4 and A9, corresponding intermediate portion of the power contact at position A4 has two widened sections 242 to also occupy neighboring positions A3 and A5 and corresponding intermediate portion of the power contact at position A9 has two widened sections 242 to also occupy neighboring positions A8 and A10. Moreover, each power contact 212 has three tail portions 25. The additional tail portions all extend from the widened sections.

The ground and power contacts in the lower row of contacts 22 are similarly designed to have widened sections 243 and 244. Moreover, the plural tail portions 25 of the ground contacts 211 and the power contacts 212 in the upper row are arranged in one line and the plural tail portions 25 of the ground contacts 211 and the power contacts 212 in the lower row are arranged in another line.

The contacting portion 23 of each contact is not widened so that a width of the contacting portion 23 of the ground contact 211 or the power contact 212 is equal to a width of the contacting portion 23 of the signal contact. Without widening the contacting portion avoids potential short circuiting of the widened power contacts. Besides current flow and heat dissipation, the plural tail portions also strengthen soldering to a printed circuit board to which the electrical connector 100 is mounted.



3

The shielding plate **3** has a main part **31**, a supporting part **32**, and a pair of soldering legs **33**.

Referring to FIGS. **3-4**, the shielding shell **4** has a top wall **41**, a bottom wall **42**, and a pair of side walls **43** surrounding a receiving space **40**. The top wall **41** has a rear extension **44**. The shielding shell **4** includes an opening **411**. The top wall further has a pair of fixing tabs **412**. The side walls **43** has a pair of positioning legs **431** and a pair of engaging tabs **432**. The bottom wall **42** has a pair of spring tangs **421**.

The water-proof film **6** has a pair of holes **61**.

The auxiliary shell **7** has a main part **71**, a pair of side walls **72**, and a rear wall **73**. Each side wall **72** has a leg **721**. The rear wall **73** has a pair of clamps **731**.

The electrical connector **100** is generally manufactured in processing steps well known in this art.

From a technical viewpoint, the subject connector **100** owns the configuration essentially compatible with the contour of the Type C connector including the contact tails in a full amount, i.e., the twelve tail portions in each row, while removing the contacting portions of the unused contacts, and further unifying the corresponding intermediate portions of those unused contacts with those of the operating/useful contacts for not only enhancing the structures thereof but also delivering much power or increasing grounding effect. As mentioned before, there are twelve positions for the contacts in each row. Notably, the arrangement of the invention is essentially in a symmetrical manner with regard to a front-to-back centerline of the tongue in the transverse direction thereof wherein the intermediate portion of the outermost ground contact owns essentially two positions, the intermediate portion of the innermost signal contact owns essentially only one position, while the intermediate portion of the middle power contact owns essentially three positions. Understandably, the whole space on the tongue is fully used in a symmetrical and systematical way based upon the standard full pin Type C connector, compared with the traditional large power delivery connector having the enlarged/widened intermediate portion thereof in an odd manner. It is also noted that in the embodiment the intermediate portion of the middle power contact has barbs on two sides while that of the outermost ground contact has barbs only on the inner side. It is also noted that the contact portion is symmetrical with regard to the intermediate portion along the transverse direction in the corresponding power contact and the signal contact while is asymmetrical with regard to that in the corresponding ground contact.

What is claimed is:

**1.** An electrical connector comprising:

an insulative housing having a base and a tongue;  
two rows of contacts arranged in the insulative housing and exposed respectively to two opposite surfaces of the tongue, each row of contacts including an outermost ground contact and an adjacent power contact next to the ground contact; and

4

a shielding shell enclosing the insulative housing, wherein each of the ground contact and the power contact in at least one of the two rows has a contacting portion, plural tail portions, and an intermediate portion between the contacting portion and the plural tail portions; wherein the ground contact has two tail portions and the power contact has three tail portions; wherein each row of contacts comprise a pair of outermost ground contacts and a pair of adjacent power contacts next to the pair of ground contacts, and the ground contacts and the power contacts in one row each have plural tail portions arranged in one line and the ground contacts and the power contacts in the other row each have plural tail portions arranged in another line.

**2.** The electrical connector as claimed in claim **1**, wherein a width of the intermediate portion of each ground contact is greater than a width of the contacting portion thereof, and a width of the intermediate portion of each power contact is greater than a width of the contacting portion thereof.

**3.** The electrical connector as claimed in claim **1**, wherein a width of the tail portion of each ground contact is equal to a width of the contacting portion thereof, and a width of the tail portion of each power contact is equal to a width of the contacting portion thereof.

**4.** An electrical connector comprising:

an insulative housing having a base and a tongue defining twelve positions in a transverse direction;  
two rows of contacts arranged in the insulative housing and exposed respectively to two opposite surfaces of the tongue in a vertical direction position to said transverse direction, in each row said contacts arranged in a symmetrical manner with regard to a front-to-back extending centerline of the tongue portion in said transverse direction and including a pair of outermost ground contacts, a pair of innermost signal contacts and a pair of power contacts therebetween; and  
each of said contacts having a front contact portion, a rear tail portion and an intermediate portion therebetween in a front-to-back direction perpendicular to said transverse direction and said vertical direction; wherein the intermediate portion of the outermost ground contact occupies two positions, the intermediate portion of the innermost signal contact occupies one position while the intermediate portion of the power contact occupies three positions; wherein there are twelve tail portions in each row corresponding to said twelve positions; wherein the contact portion is essentially symmetrical with regard to the corresponding intermediate portion in both the power contact and the signal contact in the transverse direction while is symmetrical in the ground contact.

**5.** The electrical connector as claimed in claim **4**, wherein barbs are formed on two sides of the intermediate portion of the power contact while on only an inner side of the intermediate portion of the outermost ground contact.

\* \* \* \* \*